Course curriculum for Engineering Physics -2021 Batch

Semester III (2021 Batch)			
S. No	**Course code**	**Course name**	**Instructor**
1	PH 201	Electrodynamics	Prof. Kavita Devi
2	ME 207	Thermodynamics	Prof. Hiranya Deka
3	ME 201	Engineering Mechanics	Prof. Samarth Raut
4	EE 221	Introduction to Probability (First Half Semester)	Prof. Bharath B N
5	EE 229	Electronic Devices (First Half Semester)	Prof. Nagaveni S
6	EE 202	Introduction to Analog circuits (Second Half Semester)	Prof. Nagaveni S
7	EE 210	Signals and systems	Prof. Rajshekhar Bhat

Name of Academic Unit: Department of Physics
Level: UG
Programme: B.Tech.

<table>
<tr><td>i</td><td>Title of the Course</td><td colspan="5">PHXXX: Electrodynamics</td></tr>
<tr><td rowspan="2">ii</td><td rowspan="2">Credit Structure</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2"></td></tr>
<tr><td>2</td><td>1</td><td>0</td><td>6</td></tr>
<tr><td>iii</td><td>Type of Course</td><td colspan="5">Core course</td></tr>
<tr><td>iv</td><td>Semester in which normally to be offered</td><td colspan="5">Autumn/Spring</td></tr>
<tr><td>v</td><td>Whether Full or Half Semester Course</td><td colspan="5">Full</td></tr>
<tr><td>vi</td><td>Pre-requisite(s), if any (For the students) – specify course number(s)</td><td colspan="5">Successful completion of PH102</td></tr>
<tr><td>vii</td><td>Course Content</td><td colspan="5">Review of electrostatics and magnetostatics.

Electrodynamics: Differential and integral forms of Maxwell’s equations, Scalar and vector potentials, gauge transformations, Coulomb and Lorentz Gauge; Maxwell’s equations in terms of potentials. Energy and momentum in electrodynamics.

Electromagnetic waves: Electromagnetic waves in non-conducting media: Monochromatic plane waves in vacuum, propagation through linear media; Boundary conditions; Reflection and transmission at interfaces. Fresnel’s laws; Electromagnetic waves in conductors: Modified wave equation, monochromatic plane waves in conducting media, Dispersion: Dispersion in non-conductors, free electrons in conductors and plasmas. Guided waves.

Retarded potentials, Electric dipole radiation, magnetic dipole radiation. Radiation from a point charge: Lienard-Wiechart potentials, fields of a point charge in motion, power radiated by a point charge.

Electrodynamics and Relativity: Review of special theory of relativity, Lorentz transformations, Minkowski four vectors, energy-momentum four vector, covariant formulation of mechanics; Transformation of electric and magnetic fields under Lorentz transformations, field tensor, invariants of electromagnetic field, Covariant formulation of electrodynamics, Lorentz force on a relativistic charged particle.

Waveguides, Resonant Cavities and Optical Fibers, Basics of Antennas.</td></tr>
<tr><td>viii</td><td>Texts/References</td><td colspan="5">(1) D. J. Griffith: Introduction to Electrodynamics, 4th edition, Pearson, 2015.</td></tr>
</table>

	(separate sheet may be used, if necessary)	(2) J.D. Jackson: Classical Electrodynamics, Wiley student edition, 3rd edition, 2007. (3) Modern Electrodynamics, Andrew Zangwill, Cambridge University Press, 2012. (4) Foundations of Electromagnetic Theory, J. R. Reitz, F. J. Milford, and R. W. Christy, Addison-Wesley, 4th edition, 2008. (5) W K H Panofsky and M Philips: Classical Electricity and Magnetism Addison Wesley, 2nd edition, 1962. (6) W Greiner: Classical Electrodynamics, Springer, 1998. (7) Hayt, William H., Jr., and John A. Buck, "Engineering Electromagnetics", 7th ed. McGraw-Hill, 2006. (8) M.A. Heald and J.B. Marion, Classical Electromagnetic Radiation, Saunders, 1983.
ix	**Name(s) of Instructor(s)**	Faculty, Department of Physics
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Physics and Electrical Engineering
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
viii	**Justification/ Need for introducing the course**	This is a core course for Engineering Physics Program. It deals with many aspects of electromagnetic properties, behavior of electromagnetic wave in space and materials. The formalism developed here could help in better understanding of several technologies, like, communication, antennas, GPS, etc.

Name of Academic Unit: Mechanical Engineering
Level: B.Tech.
Programme: B.Tech.

i	**Title of the course**	ME 207 Thermodynamics
ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Nil
vii	**Course Content**	Thermodynamic Systems, properties & state, process & cycle **Heat & Work**: Definition of work and its identification, work done at the moving boundary, Zeroth law, **Properties of pure substance**: Phase equilibrium, independent properties, and equations of state, compressibility factor, Tables of thermodynamic properties& theiruse,Mollier Diagram **First law**: First law for control mass & control volume for a cycle as well as for a change of state, internal energy & enthalpy, Specific heats; internal energy, enthalpy & specific heat of ideal gases. SS process, Transient processes. **Second Law of Thermodynamics**: Reversible process; heat engine, heat pump, refrigerator; Kelvin-Planck & Clausius statements ,Carnot cycle for pure substance & ideal gas, Concept of entropy; the Need of entropy definition of entropy; entropy of a pure substance; entropy change of a reversible & irreversible processes; principle of increase of entropy, thermodynamic property relation, corollaries of second law, Second law for control volume; SS & Transient processes; Reversible SSSF process; principle of increase of entropy, Understanding efficiency. **Irreversibility and availability**: Available energy, reversible work & irreversibility for control mass and control volume processes; second law efficiency. **Thermodynamic relations**: Clapeyron equation, Maxwell relations, Thermodynamic relation for enthalpy, internal energy, and entropy, expansively and compressibility factor, equation of state, Generalized chart for enthalpy. **Thermodynamic Cycles**: Otto, Diesel, Duel and Joule Third Law of Thermodynamics

viii	**Texts/References**	1. Sonntag R., Claus B. & V. Wylen G, Fundamentals of Thermodynamics, John Wiley, 2000. 2. G Rogers, YR Mayhew, Engineering Thermodynamics Work and Heat Transfer, Pearson 2003 3. J.P Howell, P.O. Bulkins, Fundamentals of Engineering Thermodynamics, McGraw Hill,1987 4. Y Cengal, M A Boles, Thermodynamics: An Engineering Approach, Tata McGraw Hill, 2003. 5. Michael J. & H.N. Shapiro, Fundaments of Engineering Thermodynamics, John Wiley, 2004.
ix	**Name(s) of Instructor(s)**	SSR
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a fundamental and core course which is essential for appreciating the thermal and fluid sciences and basics of all fluid and heat transfer.

Name of Academic Unit: Mechanical Engineering
Level: B.Tech.
Programme: B.Tech.

i	**Title of the course**	ME 201 Engineering Mechanics
ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	--
vii	**Course Content**	**Module 1:** Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy **Module 2:** Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; **Module 3:** Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines; **Module 4:** Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook; **Module 5:** Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy

		method for equilibrium. Stability of equilibrium. **Module 6:** Particles dynamics- Kinematics of Particles: Rectilinear motion, Plane curvilinear motion - rectangular coordinates, normal and tangential coordinates, polar coordinates, Space curvilinear - cylindrical, spherical (coordinates), Relative and Constrained motion. Kinetics of Particles: Force, mass and acceleration – rectilinear and curvilinear motion, work and energy, impulse and momentum – linear and angular; Impact – Direct and Oblique. Kinetics of System of Particles: Generalized Newton's Second Law, Work-Energy, Impulse-Momentum, Conservation of Energy and Momentum **Module 7:** Introduction to Rigid body dynamics Kinematics of Planar Rigid Bodies: Equations for rotation of a rigid body about a fixed axis, General plane motion, Instantaneous Center of Rotation in Plane Motion Plane Motion of a Particle Relative to a Rotating Frame. Coriolis Acceleration Kinetics of Planar Rigid Bodies: Equations of Motion for a Rigid Body, Angular Momentum of a Rigid Body in Plane Motion, Plane Motion of a Rigid Body and D'Alembert's Principle, Systems of Rigid Bodies, Constrained Plane Motion; Energy and Work of Forces Acting on a Rigid Body, Kinetic Energy of a Rigid Body in Plane Motion, Systems of Rigid Bodies, Conservation of Energy, Plane Motion of a Rigid Body - Impulse and Momentum, Systems of Rigid Bodies, Conservation of Angular Momentum. **Module 8:** Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums
viii	**Texts/References**	**Textbooks:** 1. J. L. Meriam and L. G. Kraige, Engineering Mechanics, Vol I – Statics, Vol II – Dynamics, 6th Ed, John Wiley, 2008. 2. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I - Statics, Vol II – Dynamics, 9th Ed, Tata McGraw Hill, 2011. 3. R. C. Hibbler, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press, 2006.

		References: 1. S. P. Timoshenko and D. H. Young, Engineering Mechanics. Fourth Edition.McGraw-Hill, New York, 1956. 2. I. H. Shames, Engineering Mechanics: Statics and dynamics, 4th Ed, PHI, 2002. 3. Robert W. Soutas-Little; Daniel J. Inman; Daniel Balint, Engineering Mechanics: Dynamics – Computational Edition, 1st Ed., Cengage Learning, 2007 4. Robert W. Soutas-Little; Daniel J. Inman; Daniel Balint, Engineering Mechanics: Statics-Computational Edition, 1st Ed., ,Cengage Learning, 2007
ix	**Name(s) of Instructor(s)**	TPG, PS
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a fundamental and core course which is essential for appreciating the influence of forces and force systems on particles/rigid bodies for all mechanical engineering students. This basic engineering course forms the base on which other course like Mechanics of Solids and Theory of Machines.

Academic Unit: Electrical Engineering
Level: UG
Programme: B. Tech.

i	**Title of the course**	Introduction to Probability
ii	**Credit Structure (L-T-P-C)**	(3-0-0-3)
iii	**Type of course**	Core course for EE and elective for CS
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Half
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	Exposure to Calculus (MA 101)
vii	**Course content**	• **Introduction:** Motivation for studying the course, revision of basic math required, connection betweenprobability and length on subsets of real line, probability-formal definition, events and sigma- algebra, independence of events, and conditional probability, sequence of events, and Borel-Cantell Lemma. • **Random Variables:** Definition of random variables, and types of random variables, CDF, PDFand its properties, examples of random variables, random vectors and independence, brief introductionto transformation of random variables, introduction to Gaussian random vectors • **Mathematical Expectation:** Importance of averages through examples, definition of expectation, moments and conditional expectation,use of MGF, PGF and characteristic functions, variance and k-th moment. • **Inequalities and Notions of convergence:** Markov,Chebychev, Chernoff and Mcdiarmid inequalities, convergence in probability, mean, and almost sure. • Random Process: Example and formal definition, stationarity, autocorrelation, and cross correlation function, ergodicity, KL expansion, introduction tospecial random process such as Markov chains, Martinagale and Brownian motion. • **Markov Chain:** Communication classes and its properties, stationary distribution and its existence, Poisson processes, Example applications of Markovdecision process. Applications of the tools discussed in the course in electrical engineering and computerscience
viii	**Texts/References**	1. Robert B. Ash, ``Basic Probability Theory," Reprint of the John Wiley & Sons, Inc., New York, 1970 edition. 2. Sheldon Ross, ``A first course in probability," PearsonEducation India, 2002. 3. Bruce Hayek, ``An Exploration of Random Processes forEngineers," Lecture notes.
ix	**Name(s) of the Instructor(s)**	Naveen M B

x	**Name(s) of other Departments/ Academic Units to whomthe course is relevant**	Computer Science and Engineering
xi	**Is/Are there any course(s) inthe same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing thecourse**	"Randomness" is inherent to most of the systems in electrical engineering. Especially, in the field of communication, the noiseat the receiver brings in several challenges in designing systems that are immune to noise. To face this challenge, it is fundamental to model and understand the "randomness." This course is aimedat covering tools necessary to achieve this goal through several example applications in electrical and computer science engineering disciplines.

Academic Unit: Electrical Engineering
Level: UG
Programme: B. Tech.

i	**Title of the course**	Electronic Devices
ii	**Credit Structure (L-T-P-C)**	(3-0-0-3)
iii	**Type of course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (Forthe students) – specify course number(s)**	Exposure to Introduction to Electrical and Electronics components(EE 102)
vii	**Course content**	**Modeling devices:** Static characteristics of ideal two terminals and threeterminal devices; Small signal models of non-linear devices. **Introduction to semiconductor equations and carrier statistics:** Poisson's and continuity equations, Fermi-Dirac statistics and Boltzmann approximation to the Fermi-Dirac statistics. **Semiconductor Diodes:** Barrier formation in metal-semiconductorjunctions, PN homo- and hetero- junctions; CV characteristics and dopant profiling; IV characteristics; Small signal models of diodes; SomeApplications of diodes. **Field Effect Devices:** JFET/HFET, MIS structures andMOSFET operation; JFET characteristics and small signalmodels; MOS capacitor CV and concept of accumulation, depletion and inversion; MOSFET characteristics and smallsignal models. **Bipolar transistors:** IV characteristics and Elers-Moll model;small signalmodels; Charge storage and transient response. **Discrete transistor amplifiers:** Common emitter and common source amplifiers; Emitter and source followers.
viii	**Texts/References**	1. D. A. Neamen, Semiconductor Physics and Devices, 4eEdition, McgrawHill, 13th reprint, 2016 2. E.S. Yang, Microelectronic Devices, McGraw Hill,Singapore,1988 3. B.G. Streetman, Solid State Electronic Devices, 7thEdition, Pearson, 2016 4. J. Millman and A. Grabel, Microelectronics, IIedition 34threprint McGraw Hill, International, 2017. 5. A.S. Sedra and K.C. Smith, Microelectronic Circuits,Saunder's College Publishing, 1991 6. R.T. Howe and C.G. Sodini, Microelectronics : An integrated Approach, Prentice Hall International, 1997
ix	**Name(s) of the Instructor(s)**	RG
x	**Name(s) of other Departments/Academic Units to whom thecourse is**	NA

	relevant	
xi	**Is/Are there any course(s) inthe same/ other academic unit(s) which is/ are equivalent to this course? If so, please givedetails.**	No
xii	**Justification/ Needfor introducing the course**	This is one of the preliminary courses required at the beginningof Electrical Engineering

Academic Unit: Electrical Engineering
Level: UG
Programme: B. Tech

i	**Title of the course**	Analog Circuits
ii	**Credit Structure (L-T-P-C)**	(2-1-0-3)
iii	**Type of course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Half
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	Exposure to EE 101, EE 201
vii	**Course content**	• BJT and MOSFET based amplifiers: Cascaded amplifiers. • Introduction to operational amplifiers: The difference amplifier and the ideal operational amplifier models, concept of negative feedback and virtual short, Analysis of simple operational amplifier circuits • Frequency response of amplifiers, Bode plots. • Feedback: Feedback topologies and analysis for discrete transistor amplifiers, stability of feedback circuits using Barkhausen criteria. • Linear applications of operational amplifiers: Instrumentation and Isolation amplifiers, Currentand voltage sources, Active filters. • Non-linear applications of operational amplifiers: Comparators, clippers and clampers, Linearization amplifiers; Precision rectifiers, Logarithmic amplifiers, multifunction circuits and true rms convertors • Waveform Generation: sinusoidal feedback oscillators, Relaxation oscillators, square-triangle oscillators • Real operational amplifiers: Current sources and active loads, difference, intermediate and output stages including Miller capacitors for frequency computation, • Operational amplifier parameters; Effects of real operational amplifier parameters on circuit performance. • Analog and Digital interface circuits: A/D, D/A Converters, S/H circuits and multiplexers.
viii	**Texts/References**	1. J. V. Wait, L. P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, 2nd edition, McGraw Hill, New York, 1992. 2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988. 3. A. S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, Edition IV 4. Ramakant Gayakwad, Op-amps and Linear Integrated Circuit, 4th edition, Pearson, 2000.

		5. P. Horowitz and W. Hill, The Art of Electronics, 2ndedition, Cambridge University Press, 1989.
ix	**Name(s) of the Instructor(s)**	NK
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Nil
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a core course which introduces analog amplifiers and their applications in different circuits which are used in several real life devices.

Academic Unit: Electrical Engineering
Level: UG
Programme: B. Tech.

i	**Title of the course**	Signals and Systems
ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
iii	**Type of course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	--
vii	**Course content**	• Continuous-time and Discrete-time signal (andsystem) classification and properties. • Impulse response, LTI / LSI system and properties;Continuous-time and Discrete-time convolution. • Linear constant coefficient differential (and difference) equations. • Continuous – time Fourier series and Continuous –time Fourier Transform. Their Properties. • Discrete – time Fourier series and Discrete – timeFourier Transform. Their Properties. • Sampling and Aliasing in time and frequencyDiscrete Fourier Transform • Laplace Transform and its Properties. • Z-Transform and its Properties.
viii	**Texts/References**	1. Signals and Systems, Authors: Alan V. Oppenheim, Alan S. Willsky, Edition: 2, illustrated, Publisher Pearson, 2013. 2. Signal Processing and Linear Systems, Author: Bhagawandas P. Lathi, Edition: 2, illustrated, Publisher: Oxford University Press, 2009. 3. Signals and Systems, Authors: Simon S Haykin, Barry Van Veen, Edition: 2, illustrated, Publisher: Wiley, 2003.
ix	**Name(s) of the Instructor(s)**	SRMP
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	CSE
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is one a fundamental course for Electrical and Computer Science Engineering